

*DIRECT AND DISTAL EFFECTS OF NONCONTINGENT JUICE ON RUMINATION EXHIBITED BY A CHILD WITH AUTISM*

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Previous research has demonstrated the efficacy of the noncontingent delivery of foods and liquids at suppressing rumination, the repeated regurgitation and rechewing of partially digested food. However, it is unclear how long this reduction is maintained after caregivers terminate this procedure. The current study examined the direct and distal effects of noncontingent juice on rumination by measuring the duration of rumination during juice delivery and immediately following the termination of juice delivery. Noncontingent juice suppressed rumination, but this suppression was not maintained after delivery termination.

*Key words:* autism, noncontingent reinforcement, rumination

Rumination is the regurgitation and rechewing of partially digested food and is associated with numerous health concerns including halitosis, tooth decay, electrolyte imbalances, abnormal gastrointestinal symptoms, malnutrition, and social isolation (American Psychiatric Association, 2000; Chial, Camilleri, Williams, Litzinger, & Perrault, 2003; Ellis & Schnoes, 2009). Rumination may occur in as many as 10% of individuals with severe intellectual disabilities (Rogers, Stratton, Victor, Kennedy, & Andreas, 1992). In these cases, rumination typically occurs within a few minutes after eating and may last several hours (Ellis & Schnoes, 2009). Recent evidence suggests that rumination may be operant, most commonly maintained by automatic consequences of the behavior, and can be treated through operant mechanisms (Lyons, Rue, Luiselli, & DiGennaro, 2007; Wilder, Register, Register, Bajagic, & Neidert, 2009).

Several studies have suggested that providing noncontingent food or drink will suppress rumination. For example, Thibadeau, Blew, Reedy, and Luiselli (1999) suppressed rumination by providing free access to white bread following

meals to an 18-year-old man with intellectual disabilities. Lyons et al. (2007) similarly reduced the rumination of two children with developmental disabilities by delivering small bites of preferred edible items (i.e., cereal bars and pretzels) or 1-oz (about 30 ml) sips of preferred drinks (i.e., fruit juice and fruit punch) on a fixed-time (FT) schedule. This procedure requires relatively little effort to implement; however, there are a number of important concerns regarding the distal effects of this intervention. For instance, it may not be healthy for an individual to consume food continuously throughout the day. In addition, it is unclear from these results how long reductions would be maintained after the termination of food delivery. It is possible that noncontingent food simply delays the onset of rumination.

Two studies evaluated the maintenance of reductions in rumination following intervention termination, both with favorable results. Wilder, Draper, Williams, and Higbee (1997) measured rumination exhibited by an adult man with profound intellectual disabilities and blindness during a 30-min period of noncontingent gelatin or pudding (delivered in the amount of 1 teaspoon on an FT 20-s schedule) and during a 60-min extended data-collection period after terminating delivery. The results indicated that noncontingent food was effective at decreasing rumination relative to baseline; in

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addition, rumination did not increase significantly during the 60 min following treatment termination. Dudley, Johnson, and Barnes (2002) evaluated a food satiation procedure in which they provided free access to rice cakes and other starches (e.g., mashed potatoes, pasta, and cereal) to a young girl with autism after her meals and measured rumination for an additional 50 min after she reached a satiation criterion (i.e., 3 min without approaching the food). This procedure reduced rumination during both the noncontingent food period and the following 50 min. We extended this literature by evaluating the direct and distal effects of providing noncontingent juice on rumination exhibited by a boy with autism. We measured the duration of rumination during juice delivery and immediately after terminating juice delivery.

## METHOD

### *Participant and Setting*

Bennett was an 11-year-old boy with multiple diagnoses including autism, severe mental retardation, blindness, septo-optic dysplasia, and a thyroid disorder. His teachers had referred him due to his ongoing rumination; we obtained parental consent for participation in this evaluation prior to initiating any procedures. Bennett presented with dental problems and chronically chapped lips and was socially isolated from his peers; he was not receiving any medical treatment for his rumination. Therapists conducted all assessment and treatment sessions in an unused classroom at Bennett's school.

### *Measurement and Interobserver Agreement*

Observers used laptop computers to record the continuous duration of rumination. We initiated all assessment and treatment sessions at the conclusion of Bennett's school lunch period (within 10 min of lunch completion), which teachers reported as the most frequent period of rumination. Prior to the first session each day,

the therapist viewed Bennett's mouth to ensure there was no food remaining from lunch. We defined *rumination* as engaging in a rotary chewing motion, which was the most frequent public accompaniment when Bennett ruminated. We scored the onset of an episode immediately when chewing began and the offset when chewing ceased for 3 s. We divided the sum of rumination durations by the total session duration to determine a percentage of session with rumination.

A second observer simultaneously but independently scored the occurrence of rumination during 29% of functional analysis sessions and 33% of treatment evaluation sessions to assess interobserver agreement. We divided each observer's record into 10-s intervals and compared observers' records of the number of seconds with rumination on an interval-by-interval basis. We assigned each interval in exact agreement a score of one and calculated a proportional agreement score for all other intervals by dividing the smaller number of seconds of rumination by the larger number of seconds of rumination. We then summed the scores across intervals, divided the sum by the total number of intervals, and converted this score to a percentage. The mean agreement score for the duration of rumination was 83% (range, 61% to 94%) throughout functional analysis sessions and 86% (range, 54% to 100%) throughout treatment evaluation sessions. At times, Bennett's rumination was difficult to detect due to subtle physical accompaniments (i.e., minuscule rotary chewing motions). The low minimum ranges of interobserver agreement obtained during both the functional analysis and treatment evaluation most likely were due to this difficulty in detecting rumination.

### *Procedure*

We conducted a functional analysis of rumination using procedures similar to those described by Iwata, Dorsey, Slifer, Bauman, and Richman (1982/1994), including 5-min attention, escape, ignore, and toy play conditions alternated within a multielement design, to determine if rumination

was sensitive to social reinforcement. In addition, we conducted a series of ignore sessions to verify that Bennett's rumination persisted in the absence of social consequences. We conducted four sessions per day. Following the functional analysis, we initiated a treatment evaluation that examined the direct and distal effects of noncontingent juice on rumination.

We initially conducted a baseline phase similar to the ignore condition of the functional analysis. That is, Bennett, the therapist, and one or two data collectors were present in the room during 5-min sessions; Bennett did not have access to any leisure materials or edible items; and the therapist did not provide any programmed consequences for rumination. We conducted four consecutive baseline sessions per day following Bennett's lunch period.

We conducted treatment sessions (noncontingent juice FT 15 s) similar to baseline except the therapist provided a small sip (1-s access) of apple juice every 15 s. We determined apple juice to be a preferred liquid based on the results of a prior preference assessment using procedures similar to those described by Pace, Ivancic, Edwards, Iwata, and Page (1985). We set the FT schedule at 50% of the mean interval between episodes of rumination during the last five baseline sessions ( $M = 30$  s). We conducted up to three 5-min treatment sessions per day but terminated treatment sessions early if Bennett expelled the juice during three consecutive presentations within a session (i.e., we considered this indicative of satiation; session durations are available from the second author). After he met this expulsion criterion, we conducted the remainder of that session under postnoncontingent juice conditions, which were identical to baseline. We then conducted two additional 5-min postnoncontingent juice sessions. Thus, we were able to evaluate the direct effects of noncontingent juice (during treatment sessions) and the distal effects (during the sessions that immediately followed the termination of juice delivery). The alternation

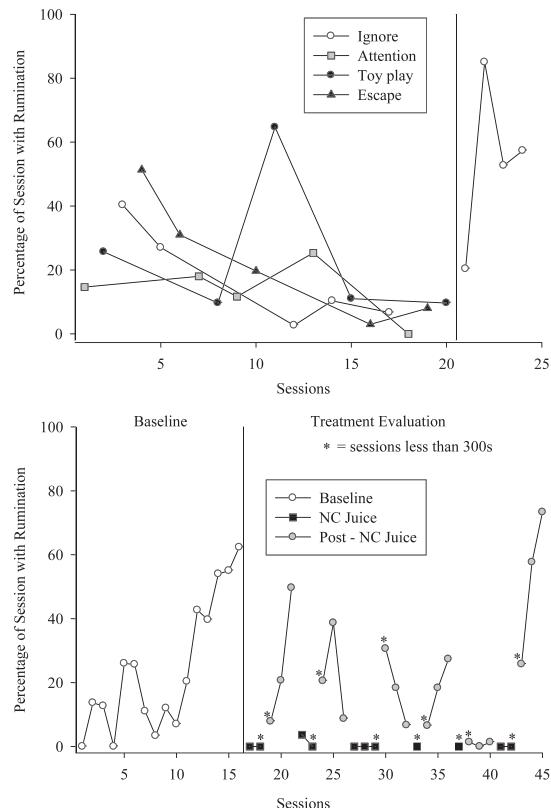


Figure 1. Percentage of session with rumination during Bennett's functional analysis (top) and treatment evaluation (bottom). NC = noncontingent.

between noncontingent juice sessions and postnoncontingent juice sessions shares the experimental logic of a multielement design.

## RESULTS AND DISCUSSION

Bennett's rumination occurred at similar durations across all functional analysis conditions ( $M_s = 17\%, 23\%, 14\%$ , and  $24\%$  during ignore, escape, attention, and toy play conditions, respectively; Figure 1, top), indicating that the duration of rumination was not influenced by social reinforcement. The extended series of ignore sessions confirmed this; Bennett's rumination not only maintained but increased ( $M = 54\%$ ) in the absence of social consequences.

Bennett's rumination increased across the baseline phase ( $M = 24\%$ ; Figure 1, bottom).

During noncontingent juice sessions, the non-contingent delivery of juice eliminated rumination completely in all but one session, producing a 98% reduction from baseline levels ( $M = 0.3\%$ ). However, Bennett never completed three consecutive treatment sessions prior to meeting our satiation criterion. He met the liquid satiation criterion within one to three 5-min sessions each day (i.e., in less than 15 min), and we observed a concomitant increase in rumination to baseline levels within the few minutes that followed treatment cessation each day (postnoncontingent juice sessions;  $M = 23\%$ ).

These results are similar to those of Lyons et al. (2007) in that noncontingent juice delivered on an FT schedule minimized rumination during brief sessions. However, both the results of Lyons et al. and the current results raise concerns regarding the use of FT juice delivery to produce lasting decreases in rumination. Following their initial intervention, Lyons et al. faded delivery by reducing the amount of juice from 1 oz (about 30 ml) to 0.5 oz (about 15 ml) and extended the session duration from 15 min to 30 min for one participant. Although rumination decreased compared to levels seen during baseline, treatment effects were not as robust as those observed during the initial intervention. In the current study, we directly evaluated satiation and maintenance effects by setting a termination criterion and measuring rumination following the systematic withdrawal of treatment, but results were not favorable, indicating that continuous provision of food or liquid may not be feasible or effective for longer periods (i.e., satiation may occur and disrupt treatment effects).

The current study produced different outcomes than previous research that evaluated rumination after treatment termination. This difference in outcomes may be due to the items delivered during the intervention. Dudley et al. (2002) and Wilder et al. (1997) provided solid foods, whereas we provided Bennett with liquids. Some research suggests that increased liquid consumption during mealtime may facilitate rumination by making

food easier to regurgitate and that simply restricting access to liquids prior to, during, and immediately after meals can suppress rumination (Barton & Barton, 1985; Heering, Wilder, & Ladd, 2003; Wilder et al., 1997). Prior to this evaluation, we attempted to provide Bennett with preferred solid and starchy food items, but he refused to accept these during sessions. He did persist in accepting juice for longer periods; thus, we evaluated the effects of juice only. The possible differential effectiveness of foods and liquids in maintaining suppressed rumination demands additional research attention.

The results of the current study do not preclude the possibility that noncontingent liquids suppress rumination in some cases but do draw attention to the necessity of continuing data collection for periods after terminating liquid (or food) delivery. It is possible that thinning the FT schedule could result in greater maintenance (similar to that reported by Lyons et al., 2007) or could identify the minimal amount of food or liquids necessary to maintain low levels of rumination. Future research should include a parametric manipulation of liquid levels and delivery schedules during and after treatment sessions. Given that delivering noncontingent food and liquids continuously throughout the day would be neither desirable (due to excessive caloric intake and dental problems) nor possible (due to satiation), it will be important to continue to evaluate the maintenance of behavior change for this and similar procedures.

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